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Performance Measurement for Information Systems: Industry Perspectives

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October 30, 1992

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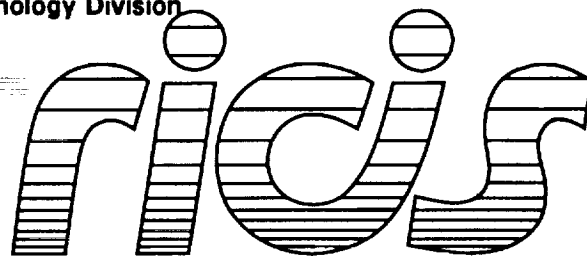
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MEASUREMENT FOR INFORMATION
SYSTEMS: INDUSTRY PERSPECTIVES
Final Report (Research Inst. for
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**NASA Johnson Space Center
Information Systems Directorate
Information Technology Division**



*Research Institute for Computing and Information Systems
University of Houston-Clear Lake*

TECHNICAL REPORT

The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information Systems (RICIS) in 1986 to encourage the NASA Johnson Space Center (JSC) and local industry to actively support research in the computing and information sciences. As part of this endeavor, UHCL proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a continuing cooperative agreement with UHCL beginning in May 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The UHCL/RICIS mission is to conduct, coordinate, and disseminate research and professional level education in computing and information systems to serve the needs of the government, industry, community and academia. RICIS combines resources of UHCL and its gateway affiliates to research and develop materials, prototypes and publications on topics of mutual interest to its sponsors and researchers. Within UHCL, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business and Public Administration, Education, Human Sciences and Humanities, and Natural and Applied Sciences. RICIS also collaborates with industry in a companion program. This program is focused on serving the research and advanced development needs of industry.

Moreover, UHCL established relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research. For example, UHCL has entered into a special partnership with Texas A&M University to help oversee RICIS research and education programs, while other research organizations are involved via the "gateway" concept.

A major role of RICIS then is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. RICIS, working jointly with its sponsors, advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research and integrates technical results into the goals of UHCL, NASA/JSC and industry.

***Performance Measurement
for
Information Systems:
Industry Perspectives***

RICIS Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems by Dr. Peter C. Bishop, Cissy Yoes and Kay Hamilton of the University of Houston-Clear Lake. Dr. Charles Hardwick served as the RICIS research coordinator for RICIS Information Systems Research.

Funding was provided by the Information Systems Directorate, NASA/JSC through Cooperative Agreement NCC 9-16 between the NASA Johnson Space Center and the University of Houston-Clear Lake. The NASA research coordinator for this activity was Wallace F. Stewart, Manager, Technology Support, Information Technology Division, Information Systems Directorate, NASA/JSC.

The views and conclusions contained in this report are those of the authors and should not be interpreted as representative of the official policies, either express or implied, of UHCL, RICIS, NASA or the United States Government.



**PERFORMANCE MEASUREMENT FOR INFORMATION SYSTEMS:
*INDUSTRY PERSPECTIVES***

Peter C. Bishop
Cissy Yoes
Kay Hamilton

October 30, 1992

Cooperative Agreement NCC 9-16
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EXECUTIVE SUMMARY

Measuring an organization's performance is an essential component in the recent drive toward quality in U.S. business and government operations. Managers can no longer rely exclusively on their intuition or "feel"; they must use real data to guide their organizations toward their goals. The movement toward "management by results" is affecting all institutions--business, government, and education.

The Information Services Directorate (ISD) of the NASA Johnson Space Center (JSC) requested a study of this movement among information system (IS) organizations in industry. ISD was establishing a new support contract and reorganizing itself to better serve its customers. They wanted to develop their performance measurement in light of industry's experience.

Researchers at the University of Houston-Clear Lake interviewed IS executives at six large corporations in finance, oil and gas, utilities, and waste disposal. The executives described their IS measurement system, how it had developed, and how satisfied they were with it. They also discussed what they were doing to improve their systems and what they thought NASA should consider as they embarked on their own system. The respondents were extraordinarily generous with their time and shared a number of valuable insights with the interviewers.

The most important insight was that establishing a performance measurement system was more an organizational than a technical issue. Securing the commitment of employees and executives to collect and use measurement data was the most crucial element. That commitment in turn created new ways of thinking and acting that drove the organization to improve. As one executive put it, "The things you measure improve; the things you don't measure, don't." Performance measurement required a cultural change to be successful and touched off similar cultural changes of its own.

Another important insight was that the customer is central to measuring performance. Firms measured their customer satisfaction in various ways. Some routinely surveyed their customer; others met with customer executives to discuss next year's strategic plans. However they did it, the customer's view was paramount, particularly in those organizations which had been conducting formal measurement the longest.

Finally, respondents emphasized how long a suitable measurement took to develop. One firm negotiated with their outsourcing contractor for over two years before they had a measurement system that both could support. Other firms had been measuring their performance for ten years and were still modifying and improving it. Firms hired consultants and research services to help compare themselves with their industry; they devoted internal resources to preparing reports and analyzing changes. Performance measurement is not free; rather it is an investment which firms are making in their long-term improvement.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting department in ensuring the integrity of the financial data.

2. The second part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets and specialized accounting software.

3. The third part of the document describes the process of preparing financial statements and the importance of ensuring that all data is accurate and up-to-date.

4. The fourth part of the document discusses the role of the accounting department in providing financial advice to management and the importance of maintaining a high level of confidentiality.

5. The fifth part of the document outlines the various ways in which the accounting department can contribute to the overall success of the organization, including through the use of financial analysis and budgeting.

6. The sixth part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting department in ensuring the integrity of the financial data.

7. The seventh part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets and specialized accounting software.

8. The eighth part of the document describes the process of preparing financial statements and the importance of ensuring that all data is accurate and up-to-date.

Respondents also shared their experience in four specific domains of performance measurement: customer satisfaction, data processing, application development and end-user computing. Firms used two primary strategies for gauging the satisfaction of their customers: end-user surveys and executive interviews. These data were used as the final measure of the organization's performance and the success of its improvement strategies.

Two firms in the sample did not have customer satisfaction measures. One had recently discontinued their customer survey under a cost-cutting and downsizing exercise. One was currently reluctant to institute customer surveys for fear of raising customer expectations beyond what the organization could deliver.

The organizations which had such customer satisfaction measures did in fact report an initial period when customers demanded extraordinary service. Responding in good faith, however, the IS organization soon impressed customers with their willingness to change and their desire to do the best job possible. The result from successfully using customer satisfaction measures was a partnership between IS and its customers that resulted in significant improvement in service and joint decisions about future improvements.

Five firms managed large data processing centers. Their measurement systems were stable and mature, resulting from ten years of development. Most firms distributed monthly hardcopy reports of numerous processing indicators. The most important measures were availability and response time. The reports were distributed widely to both IS and customer organizations. One firm maintained an on-line system that presented a daily report-card to its major data processing centers.

Few of these measures, however, contained preset criteria or targets to be met. The on-line system did require specific availability and response time and subtracted points from the center's overall score when values fell below those targets. Another firm had negotiated a detailed set of metrics with its major support contractor, requiring a specific level of service for every measure they took.

Firms were expending most of their effort to improve performance measurement in application development. Previous systems were largely time and effort reporting by project. Productivity and quality statistics were calculated using source lines of code (SLOC) as the unit of work. Firms were now recalibrating their measures in terms of function points, a presumably more valid measure of work in software development. They were measuring the function points in their existing and new systems as the basis for re-defined productivity and quality measures.

Firms were also linking their measures to critical business issues in application development. Previous systems merely reported the time and effort against projects, but other measures like quality and cycle-time were difficult to capture. They are now developing measures explicitly for the most important issues in their development areas.

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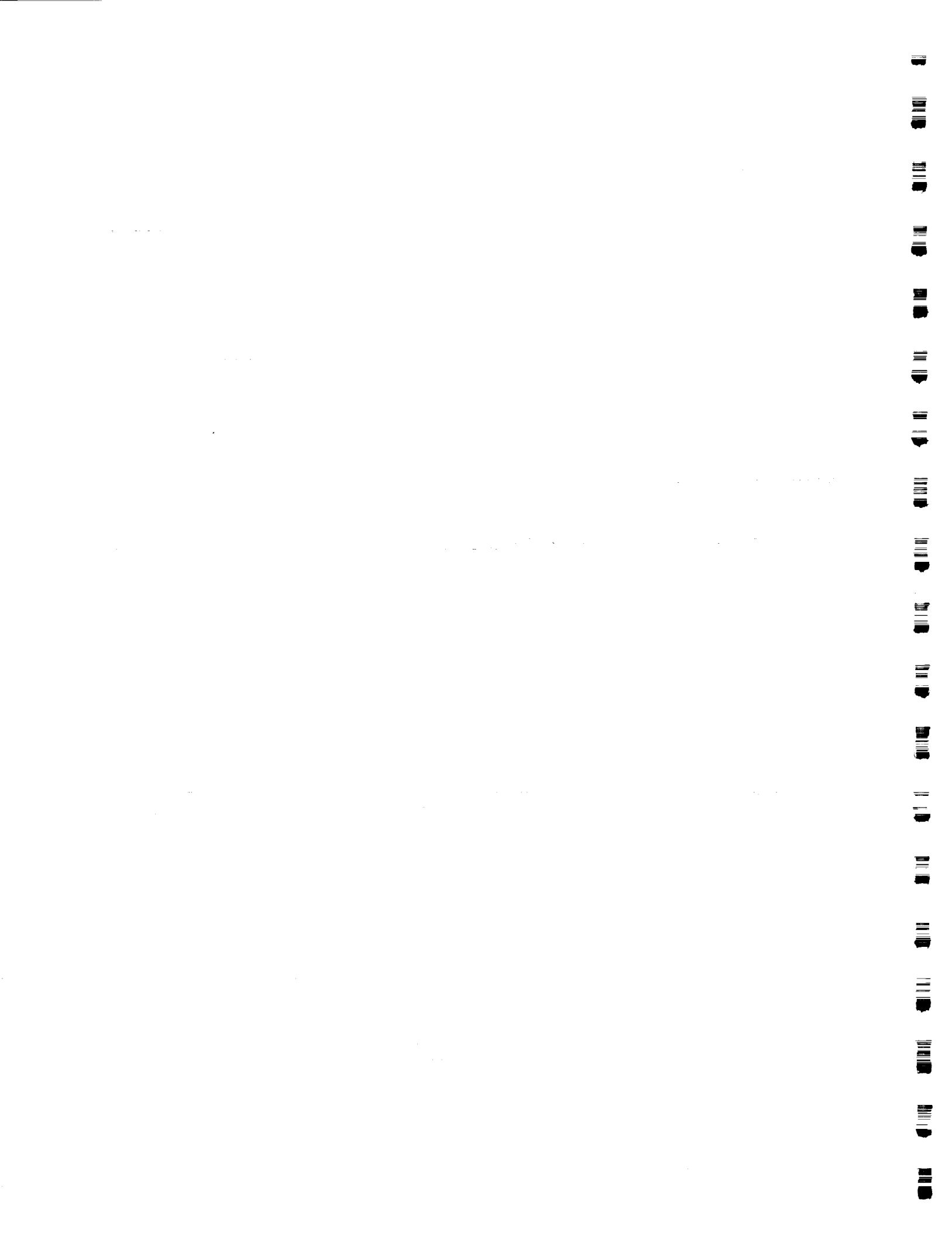
In the absence of clear and valid measures for application development, firms executed service agreements with their customers detailing the specific measures to be used on each project. One firm also contracted with outside reviewers to conduct a quality audit of every major development project every quarter to assess progress to date and risk of future problems.

Finally, the area of end-user computing presented the greatest challenge to performance measurement in these firms. The tools and techniques to measure performance in end-user computing have not caught up with the new technology and proliferation of workstations and local-area networks. Firms have had to settle for measuring their response to service requests and troubleshooting as the only valid measure in this area. Some are expecting full end-to-end network and workstation measurement tools to be available in two to three years.

Respondents were also asked to share their experience with NASA who was developing a new performance measurement system. They described that good working relationships among all the people affected by the measurement system were essential to its success. They stressed that the development phase should be carefully planned and that outside assistance was important. Even then the development could be long, and the results would still need further refinement as the system was put in place. Finally, they pointed out that cultural change was both a pre-requisite and the result of a successful performance measurement system.

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PERFORMANCE MEASUREMENT FOR INFORMATION SYSTEMS: INDUSTRY PERSPECTIVES

INTRODUCTION

Performance measurement has become a focal topic for information systems (IS) organizations. Historically, IS performance measures have dealt with the efficiency of the data processing function. Today, the function of most IS organizations goes beyond simple data processing. To understand how IS organizations have developed meaningful performance measures that reflect their objectives and activities, a study was undertaken to survey industry perspectives on IS performance measurement. This is the final report on that study.

Six IS organizations were interviewed to glean an understanding of their approach to performance measurement and how their measurement system was developed. This report contains the results of those interviews. The report provides examples of how some of the most forward looking companies are shaping their IS processes through measurement.

The organization of this report provides for 1) background information on this research study including the objectives, scope and approach the study follows, 2) description of the sample population, 3) trends in performance measurement systems, 4) patterns by product/service category, 5) recommendations to NASA as they undertake to reshape their IS performance measurement system; and finally, 6) suggestions for managers undertaking the development of a meaningful performance measurement system. Included in the appendices of this report are beginning thoughts on the presence of a life-cycle to performance measures development and a suggested taxonomy for performance measurements.

All of the firms interviewed were exceedingly generous in their time and information. Their generosity also indicated their interest in learning more about industry practice in this area. The study team hopes that this report furthers that learning process.

BACKGROUND

U.S. industry is responding to the competitive challenge of the global economy by adopting the principles of quality management in every line of business. The principles involve a renewed customer orientation, an increased attention to process, and a commitment to reduce defects, cycle time and cost.

One component of a quality approach is the measurement of process and outcome variables on a regular basis. Managers are adopting the popular phrase, "If you don't

measure it, you can't manage it." The approach is "management by fact" as opposed to management by opinion, intuition, or political advantage. Few people would feel comfortable with an airline pilot navigating by dead reckoning. Similarly, managers who used to manage "by the seat of their pants" are now using key indicators to guide them and their processes.

Quality principles are also beginning to affect government agencies. The popular book Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector by David Osborne and Ted Gaebler¹ contains cases of government officials who have employed these principles. One of those officials is the newly appointed administrator of the National Aeronautics and Space Administration (NASA), Daniel Goldin. Mr. Goldin, a former program manager for TRW Space Systems, brings his success with industrial quality programs to the task of leading the nation's space agency. In describing his vision for the NASA procurement system, Mr. Goldin said,

We must have a procurement system which focuses on the customer -- a system in which each individual is empowered to do his or her job with excellence, with clear lines of authority and responsibility.²

The same can be said of any NASA function, including information systems (IS).

Even before Mr. Goldin's appointment, the NASA Johnson Space Center (JSC) had embarked on a quality program throughout its operation. Charged with planning and conducting space shuttle missions, JSC leaders set ambitious goals for reducing the time and cost of the missions.

The Information Systems Directorate (ISD) is participating in the JSC initiative. ISD maintains the center's computer facilities and telephone networks and assists end-users by acquiring and supporting workstations and software. ISD consists of 125 government employees who supervise thousands of subcontractor personnel. Together ISD and the contractor support data processing facility consist of IBM and IBM-compatible mainframes connected by an SNA backbone network. The network serves the majority of the 3,000 government and many of the 15,000 contractor employees at JSC. ISD is also responsible for acquiring and supporting PCs, workstations and local area networks as well as the JSC telephone network and its computer connections to wide-area networks.

ISD is establishing a new five-year support contract on January 1, 1993. The timing of this contract and the new NASA quality initiatives makes the investigation of quality and performance measurement timely.

¹Reading MA: Addison-Wesley, 1992

² Dornheim, Michael A. (1992) "NASA Hopes to Slash Contract Cost 5 to 10 % By Using TQM in Procurement," Aviation Week & Space Technology, August, 3, pp 22-23.

In order to get a more accurate picture of how performance measurement was being practiced, ISD asked a research team at the University of Houston-Clear Lake to study how industrial IS departments measured their performance. The research team conducted the study under a cooperative agreement between JSC and the university where government, academic, and industrial organizations cooperate on strategic issues in computing and information systems.

The university study team had previously conducted a literature review on performance measurement for ISD. The review concentrated on the most important element of performance within the quality perspective -- the customer's perspective.³ The study found a wide variety of techniques for measuring customer satisfaction documented in the literature. The most important techniques were customer surveys, executive interviews, service level agreements, and post-work complaints and compliments. IS organizations were also careful to align their customer focus with corporate goals, identify their own critical success factors (CSFs), and benchmark their performance against similar organizations. About 65% of Computerworld's Premier 100 IS organizations did some kind of formal evaluation of customer satisfaction.⁴

Having concluded that study, ISD was interested in a broader study in two respects: expanding the focus to include all IS performance measures rather than just customer satisfaction and gathering information directly from industrial organizations rather than that found in the literature.

OBJECTIVES

The objectives of the new study were:

- to understand the state of the practice in IS performance techniques for IS performance measurement
- to gather approaches and measures of actual performance measures used in industry
- to report patterns, trends, and lessons learned about performance measurement to NASA/JSC

³Bishop, Peter C., and Yoes, Cissy . **Exploratory Study on Performance Measures as Indicators of IS Effectiveness.** Houston TX: Research Institute for Computing and Information Systems (RICIS), UH-Clear Lake, May 1992.

⁴ Maglitta, Joseph and Sullivan-Trainor, Michael L. (1991) "Do The Right Thing(s)," Computerworld Premier 100, September, 30, pp 6-15.

SCOPE

Although the study is designed to gather information on performance measurements in other organizations, it is not technically a benchmarking study which would require a more intensive examination of detailed areas. Rather this study simply gathers information in preparation for the new support contract and for the performance measurement initiative.

APPROACH

Because of the complexity and depth of the information required, the study team elected to use face-to-face, open-ended interviews as its principal data gathering technique. An interview protocol was developed, a sample of corporations was drawn and the interviews were conducted.

First, the study team developed an interview protocol that covered the major elements of IS measurement. The interview was designed to gather information on four aspects of the respondent's performance measurement system:

- a description of the current system
- a history of how the system came to be
- the respondent's satisfaction with the system
- expected improvements and developments in the system

Interviewers also asked for recommendations that respondents might have for NASA as it embarked on its own performance measurement system. The interview protocol is contained in Appendix A. Respondents received an outline of the topics one week before the interview.

Two interviewers conducted each interview.⁵ One interviewer asked the questions (the questioner) and the other recorded the data (the recorder). The recorder asked clarifying questions at the end of the interview. The recorder transcribed the interview notes within 24 hours. The questioner reviewed and edited the notes.

The interview team also gathered documents on the respondent's performance measurement system when they were available. Documents were given to the study team with the understanding that confidentiality would be maintained.

⁵A NASA representative also attended one of the interviews.

SAMPLE

The most important criterion for selecting firms was their size. Large firms with substantial IS resources would be most comparable to the ISD environment. All firms in the sample had more than one billion dollars in annual revenue. Characteristics of the IS division in each firm are contained in Table I.

The firms selected came from a pool of 25 members of the Information Systems Research Center (ISRC) in the School of Business Administration at the University of Houston. The ISRC is a facilitating organization designed to bring together MIS academicians and practitioners on topics of mutual interest. One of the objectives of the ISRC is to study the development, implementation, management and utilization of information systems in organizations.

The firms selected came from the following industries.

- finance
- oil and gas
- utilities
- waste disposal

Table 1

| PERFORMANCE MEASURES - INDUSTRY PERSPECTIVES | | | |
|--|---|--|--|
| DESCRIPTION OF THE ORGANIZATIONS | | | |
| COMPANY | EMPLOYEES/ IS CUSTOMERS | IS ORGANIZATION | REVENUE SERVICE |
| ABC | <ul style="list-style-type: none"> • 7500 • 4000 employees on LANS | <ul style="list-style-type: none"> • 6 Executives • 7 company staff • 600 outsource staff | <ul style="list-style-type: none"> • Direct chargeback to outsourcing contractor |
| EDF | <ul style="list-style-type: none"> • 1356 • 296 Branch offices | <ul style="list-style-type: none"> • 200 staff | <ul style="list-style-type: none"> • Control operations budget • Control development budget |
| GHI | <ul style="list-style-type: none"> • 1356 employees | <ul style="list-style-type: none"> • 199 staff | <ul style="list-style-type: none"> • Control capital budget • Control development budget |
| JKL | <ul style="list-style-type: none"> • 40,000 employees | <ul style="list-style-type: none"> • 850 staff | <ul style="list-style-type: none"> • Chargeback covers operational budget • Additional R&D budget • Customers free to purchase outside services |
| MNO | <ul style="list-style-type: none"> • 26,000 employees • 400 locations | <ul style="list-style-type: none"> • 280 staff | <ul style="list-style-type: none"> • Development budget • Operations budget |
| PQR | <ul style="list-style-type: none"> • 26,000 employees | <ul style="list-style-type: none"> • 170 staff | <ul style="list-style-type: none"> • Allocation algorithms • Full-cost recovery for operational budget • Control capital budget |

All firms used large data processing facilities. One respondent served in an applications development and end-user support organization only. They purchased their data processing from a subsidiary of their parent firm. As a result, that respondent was unable to give us information about central data processing measures.

All of the divisions had some responsibility for end-user computing, though two firms allowed their customers to purchase goods and services from outside vendors. Three also had responsibility for the telephone operations in their firms. Finally, all IS division heads were either corporate officers (vice-presidents) or they reported to them.

Organizations varied on the degree to which their customers⁶ were autonomous from the central IS function. Two firms maintained highly centralized operations in which all of the IS resources were managed within the IS organization. The IS organization managed the capital budget which it allocated after consultation with its customers. While some outsourcing does take place, it is usually done in conjunction with IS planning and assistance.

In contrast, one firm's business units maintained their own application development units and could purchase IS products and services directly from outside vendors. The IS organization, therefore, had to compete for customer dollars with all the vendors in the IS industry.

Five organizations delivered the bulk of their products and services themselves. One firm supervised a large outsourcing contract. The vendor owned and maintained the firm's data processing facility for all but the most critical IS operations. The outsourcing relationship dramatically shaped that firm's approach to performance measurement. Since they could not control performance or its measurement on their own, the company initiated extensive and fruitful negotiations with their incumbent contractor. The process was complicated because the original contract made no explicit provisions for quality improvement.

As a result, the development process for their performance measurement system was extensive because the details were crucial both for the company and its contractor. Both negotiated in good faith and came to an agreement that supported the quality of the IS function while being fair to both parties. The negotiations began with contractor measures applied to company data which provided the baseline on the historical level of service. The parties then developed their definition of minimally acceptable and outstanding service. They used a third-party negotiator to help reach agreement.

The result is the most explicit and detailed performance measurement system in the sample. This case most closely parallels the NASA context. Although NASA owns its facilities which this firm does not, both work closely with a large contractor force to provide service to IS customers throughout the organization. One critical element which the respondent stressed was the need for mutual trust and respect across the contract.

While negotiating new performance measures with a contract already in place is not ideal, this firm has shown that it can be done and that it can enhance the working relations between customer and contractor. What was an arms-length business deal is moving to a genuine partnership.

Three organizations charged their customers for services. In the firm with the major outsourcing contract, charges went directly from the contractor to the business unit. The

⁶In this report, "customers" refers to the IS customers which are users and organizations in the same corporation. No IS organization served the corporation's final customers directly.

other two chargeback organizations funded their budgets through the delivery of products and services. One firm does not charge customers directly, but they do report usage and costs to each application owner and each line manager once a year. The costs were based on the total IS budget times the proportion of resources used by each application and by each organization. Though not charged directly, managers were able to tell how much of the corporate resource they were using.

GENERAL FINDINGS

Requirements for a Successful Performance Measurement System

The most consistent finding across all the interviews is how difficult it is to institute a successful measurement system. All respondents reported that the firm needed a different mind-set to use performance measurement for management and quality improvement over more traditional practices. Every respondent indicated that their organization had extreme difficulty changing the mind-set of the organization. Respondents frequently returned to the themes of "cultural change" and "paradigms" whenever the topic turned to implementation.

The problem of implementation was not technical. Given some baseline data and a team of willing members, performance measurement systems can be developed. Only one respondent attributed some difficulty to the technical details of the system. Even at that, changing the mind-set of the firm and the contractor was still the key element of success.

For a successful implementation, the following changes were recommended by several respondents:

- Management by fact is a term that describes a management style that relies on consistent and valid measures to make decisions and guide actions. Two phrases that describe this management philosophy occurred in more than one interview:

If you don't measure it,
you can't manage it.

Things which are measured improve;
things which are not measured don't.

- Measurement should begin and end with a customer focus. Technical measures of machine performance are important for delivering service, but they are only the means to the end. The measurement program should concentrate on whether IS helps customers meet their goals.

- Organizations and teams must have goals to which the measures are linked before meaningful measures can be developed. Measures that are simply "nice to know" were usually ineffective and soon discarded.
- Measurements should be developed by and for the people being measured. They know the process better than managers and consultants do, and they are more affected by the results. Employees have to see that the measurement program benefits them directly in their work for them to spend the time keeping it up.
- Measurement takes time and money. Large firms were spending up to .50 FTE (full time equivalent) compiling the hardcopy reports on their data processing centers alone. Customer surveys need to be developed, interviews need to be conducted, function points need to be counted, data needs to be analyzed and interpreted. Measurement is not cheap.
- Measurement must be followed by visible decisions and actions based on the measurement. If the measures don't make any difference in anyone's behavior, they soon lose their importance and support. Something important must be riding on the outcome of the measure.

Overall the cultural change accompanying performance measurement was singled out as the most important prerequisite for a successful system. Measurement systems either accompany or follow organizational change. They are never simply an additional item to an existing operation.

Trends in Performance Measurement System

Past experience and current plans of major IS organizations indicate that a pattern of change and new measurement strategies are emerging.

Automatic measurement

One of the clearest trends for the future is the move to more automatic measuring systems. Machine instrumentation is no doubt more reliable and less costly than manual methods. Thus SMF and MICS data on mainframes are the most sophisticated and mature IS measurements. Automatic processes are expected in software development as the result of adopting CASE architectures. Network management tools are developing rapidly and may soon be able to identify problems at the customer's workstation that are effecting availability and performance.

Experience showed that manual measurement systems were harder to keep up. People do not consistently log data on their service requests or development tasks, for example. Often they simply do not have the time to document their work.

No respondent, however, recommended that automatic measurement was essential. Some measures, even manual ones, are better than none. Manual measurement was successful as long as it was attached to a business goal and people understood why it was important and what they would gain from the process.

Individual and team ownership

One firm responded to the problem of collecting measurement data with an extensive training program on performance measurement--not only with how to collect the measures, but why collect them. When the employees realized how helpful it was to know the volume of requests, the average time to resolution, and the number of open requests, they kept the measurement system up-to-date themselves.

Another firm is using an aggressive teaming strategy to meet the challenge of IS performance. As a result, the performance measurement system is migrating to the team level as well. Work teams develop, collect and use their own measures themselves. They do not necessarily report them to the central office. The IS office will continue to monitor the division's performance through customer surveys, but individual activity measures, except for data center operations, are not as visible to the central office as they used to be.

The lesson here is that measurement systems compiled for someone else's use (i.e., management's) usually fail. If the measure takes time, then the individual expending that time must see some direct benefit in their work.

Fewer and more focused measures

Another trend is to reduce the number of measures which firms rely on. Automatic measurement often generates too many measures. Firms are trying to link their measures to business goals and to establish reasonable criteria for success. A few well-thought measures are better than a haphazard array.

Summarizing multiple measures

Summarizing even a few measures for quick assessment or management monitoring is always a problem. Some companies used averages or other more complex techniques for combining measures. A more common measure, however, was the percent of times the measure met the criterion.

For higher level summaries of the data, firms are moving to report cards (one overall assessment of the total area) and exception reporting (times that the measure failed to meet the criterion). The on-line system for data processing measurement in one firm combined both of these trends. Any score below its report card value of 100 indicates that a failure occurred. The user can then drill down into the data to find out where the exception occurred.

Detailed Problems and Lessons Learned

Respondents also identified perennial problems and lessons learned with performance measurement (Table 2). The most serious problem is collecting manual data. It is difficult to establish procedures which are accurate and cost effective. Some firms even abandoned manual systems because of these problems. Those which succeeded were developed by and for the people who were to collect the data and were supported by sufficient training to insure consistent operation. A second problem mentioned by more than one respondent was the issue of getting the right number of measures and the right level of detail. Too many measures can be as meaningless as not having enough measures. By the same token, striving for maximum measurement precision is an unnecessary burden on the measuring process.

The final difficulty was to keep the measures current against the changing needs of the business. Two firms had just been through a major corporate restructuring and one firm was experiencing one as we spoke. These events create new visions and goals for the organization, the progress toward which needs to be measured. The lesson is that no measurement system is static. Solving the perennial problems and serving a dynamic business require measures to be flexible throughout their lifetime.

Firms also shared a few specific lessons which they learned in designing and implementing their measurement systems. (Table 2) The most important lesson is that the human dimension of the measurement system is more important than the technical details. Finding out the needs of the business, getting and keeping everyone involved, reporting results back to the customer -- all of these require attention to the human relations aspect of performance measurement. Firms also reported some lessons on the technical side: daily DP data is more useful than monthly summaries; begin the design process with some benchmark data; use consultants to facilitate joint design sessions between companies and outsourcing contractors. The firms also admitted that the process of establishing a performance measurement system takes time, and attention to details is one of the criteria for success.

Table 2

| PERFORMANCE MEASURES-INDUSTRY PERSPECTIVES | | |
|--|--|--|
| DETAILED PROBLEMS AND LESSONS LEARNED | | |
| COMPANY | PROBLEMS IDENTIFIED | LESSONS LEARNED |
| ABC | <ul style="list-style-type: none"> ● Perception of Details | <ul style="list-style-type: none"> ● Use consultants to develop comparison studies ● People don't want to spend money to tell good news ● Maintain in-house systems which are critical to mission ● Tangible evidence is important ● Use creative adaptation of what is available |
| DEF | <ul style="list-style-type: none"> ● People who don't know what the data is for are not motivated to collect and use it | <ul style="list-style-type: none"> ● Use consultants to kick off customer and employees surveys |
| GHI | <ul style="list-style-type: none"> ● Difficult to get data unless it is embedded in the process & comes out automatically ● Motivation ● Content ● Budget ● Lack of the "Big Picture" | <ul style="list-style-type: none"> ● Monthly data not as revealing as daily data ● Lack of definitions about what is right outcome <ul style="list-style-type: none"> ▶ Ambivalent about productivity ▶ Traffic & Quality |
| JKL | <ul style="list-style-type: none"> ● Metrics hang-on to past usefulness ● Easy to develop & use metrics in stable technology but almost impossible with new technology | <ul style="list-style-type: none"> ● Include vendor as part of the process for setting goals and metrics ● Under force of new business organization, metrics have been pushed down the organization just like everything else |
| MNO | <ul style="list-style-type: none"> ● Progress can be faked with a flurry of metrics ● Need buy in from the person being measured | <ul style="list-style-type: none"> ● Metrics don't need to be more precise than the decision or actions that depend on them. Ultra-precision may be too costly ● People who know the process can usually design the metrics better than anyone |
| PQR | <ul style="list-style-type: none"> ● Measures proliferate without meaning | <ul style="list-style-type: none"> ● Satisfy first the executive who pays the IS bill ● Feedback data on performance to customers as a way to strengthen partnerships |

PATTERNS BY PRODUCT/SERVICE CATEGORY

The interview team also discerned some patterns by the IS area being measured. Performance measures occurred in four categories. The areas covered here are customer satisfaction, data processing, application development, and end-user computing.

Customer Satisfaction

Customer satisfaction is the most important attribute that an organization has in the current TQM environment. The longer organizations evolve their performance measures, the more they realize that the customer is the final arbiter of all quality issues. That insight does not come right away, but rather only after a long period of dialogue with the customer and trial-and-error with IS improvement. Only then do customer partners become an integral part of the IS business.

Most firms begin their customer satisfaction measures with a customer survey. All respondents reported that designing and conducting customer surveys was more difficult than it appeared. They also wanted their survey to be fair and anonymous, particularly the first time they delivered it. As a result, all initially contracted with a consulting firm to help them develop their survey material. After that experience, most were able to continue the process on their own.

Organizations typically passed through a series of stages for their customer measures which is described more fully in Appendix B. The first round of customer surveys usually surfaced more problems rather than providing constructive help. Customers "dumped" all their frustrations with computing on the IS organization. After that stage, however, IS organizations began to initiate real dialogue for improving their operation and assisting the customer in meeting their goals.

Part of the dialogue with the customer was the time taken to report the results of the surveys back -- either in hardcopy publications, on-line systems, or management briefings. Verifying what IS hears from the customer is an excellent way of confirming that IS is listening and correcting any misunderstandings that may arise.

Furthermore, customer input also had to create a visible change in IS performance. Customers who see real change will be more ready to offer useful feedback in the future and work with the IS organization for mutual benefit. The final stage is a partnership between IS and its customers for the benefit of both. Customers can do their job better with a well performing IS organization, and IS has loyal customers on their side when assistance is needed. Continuing dialogue toward even more improvement commences at that point, keeping the relationship alive.

Customer satisfaction--examples

One firm is considering combining a manager and an end-user survey into one instrument. The combined instrument may be the basis for providing financial incentives for contractor performance. Financial awards will be awarded by the customer unit when it has surplus funds, and when the contractor has earned an excellent rating on the satisfaction measures.

A second firm uses both a customer and an employee survey to gather data on its IS performance. They report receiving between 35% and 40% return on the customer survey, indicating a lot of interest in responding. The employee survey also generates wide participation. It measures employee satisfaction on 11 attributes, asking for a performance and an importance rating for each attribute.

Two firms conduct periodic interviews with its clients to determine their satisfaction with its performance. The interviews at one firm concentrate on the behavior of the IS personnel more than the systems they provide. The attributes they measure are:

- accessibility
- responsiveness
- problem solving ability
- technical support
- on-time delivery
- reliability
- attitude
- competence
- communication
- understanding requirements
- administrative practice
- value

Customers are asked how important each attribute is, how well the organization has conformed to requirements and how much it has improved or declined. They are also asked for items that are done particularly well and suggestions for improvement. Finally, the customer awards an overall performance rating from 1-5 with an explanation for the rating.

Another approach is found in one IS organization whose goal is to be a business partner to their customers. They define their customer both as the business unit executive with financial responsibility for computing and as the individual end-user. Each unit also employs a business information manager, a member of the customer organization, who is responsible for maintaining the quality of IS service to that unit.

The business information manager assesses the quality of that service annually in a series of meetings with the executive and computing teams in his unit. The structure of the assessment is open, but IS suggests topics such as areas that are well done and those that

need improvement, key questions and expectations for the next year, and a management message -- i.e., the overall impression which the business unit wants to leave with IS management.

The business information manager finally awards a three-scale score (are delighted⁷, meets requirements, doesn't meet requirements) on four attributes (responsiveness, effectiveness, professionalism, and understanding the unit's business). They arrive at that score after review with the senior business executive. The scores and other pertinent data are reported to IS management during a "read-out" process that covers several weeks. The read-out opens the strategic planning process for the coming year. Customer executives and computing teams also receive a briefing on the results of the assessment and planned focus for the new year by the business information manager. This approach is classical industrial marketing -- concentrating on the customer who pays the bills.

Their measurement system continues to evolve, in fact going against the trend to reduce the number of measures. The current system focuses on three service areas (planning, new capabilities, existing capabilities). They will expand that next year to eight areas for more detail. They are also likely to expand the number of attributes measured. Finally, they are instituting a series of periodic quarterly checks to capture more frequent data. The system had been pared down too much, and they are readjusting to a more moderate level. Overall, however, the system provides IS with high level customer feedback to select goals and focus areas for the coming year.

In sharp contrast to the increasing emphasis on customer satisfaction, one firm recently discontinued its customer survey to save money. In the midst of downsizing, they did not feel that they were getting sufficient value from the survey to warrant its cost.

Another firm has never formally measured its customers' satisfaction. The department already knows where the problem areas are and believes that a customer survey might increase expectations beyond what they can deliver, thus making attitudes worse. Customer satisfaction is recapped in Table 3.

⁷A "delighted" rating means the organization delivers on requirements that the customer did not ask for or expect (e.g., not only getting a good deal on a rent car, but having it delivered to your house, too).

Table 3

| <i>PERFORMANCE MEASURES - INDUSTRY PERSPECTIVES</i> | |
|---|--|
| FINDINGS-CUSTOMER SATISFACTION | |
| COMPANY | EXAMPLES |
| ABC | <ul style="list-style-type: none"> • Manager and end-user survey combined • Report card being developed • Possible financial incentives |
| DEF | <ul style="list-style-type: none"> • Customer and employee surveys • Consultant initiated |
| GHI | <ul style="list-style-type: none"> • None |
| JKL | <ul style="list-style-type: none"> • Customer Surveys • People focus more than machines |
| MNO | <ul style="list-style-type: none"> • Survey discontinued |
| PQR | <ul style="list-style-type: none"> • Executive focus • Business manager in customer organization |

Data Processing

The mainframe oriented measures are almost uniform throughout the industry. They have been around for decades, automatic tools exist which generate the data. Most of the measures come from SMF type data logged on IBM mainframes.

Benchmark databases and services are available for those wishing to compare themselves with other organizations. Two of the firms benchmarked their operations against industry peers annually using the Real Decisions⁸ database. One firm has used Real Decisions occasionally, and one collected the benchmark data themselves.

The most important data processing attributes measured are availability and response time to customers. Firms developed criteria or targets for those few measures which were considered crucial. Firms also record trend data on many other attributes. The data is usually packaged into hardcopy reports and distributed to IS and customer management on a monthly basis. One firm is reorganizing its report which was organized by department to one which organizes the data by product/service category to increase its customer orientation.

Two respondents reported that the daily DP data was more useful than the monthly statistics. The monthly data either hid important short-term variations or they were always so high that they became meaningless.

⁸ Real Decisions Corporation, Darien Connecticut

Data Processing--examples

The company with the outsourcing contract had the most detailed set of performance measures as a result of the long negotiation with their outsourcing contractor. They divided their services into 17 service levels, each measured with a service level agreement. The agreement includes a format for each of the performance measures of that service (Table 4). The format consists of general descriptors for each service and one or more levels for that service. For example availability of a system would be the service, and 98.5% of the time the level.

The agreement contains special provisions for the quality of the central data processing services. They identified nine categories of service level agreements here. The categories cover availability, response time, turnaround time, and various management functions. Exact levels are specified for each category for each of the computing environments they support.

The agreement does not cover existing application systems. Application managers are reluctant to spend the time and money instituting and supporting measures at the application level. They have fairly good systems running today and do not feel the need to verify that further. This belief that measurement is unnecessary for smoothly running systems was common in other firms as well. The problem is how to keep an emphasis on improvement in systems that have apparently maximized their performance.

No financial penalties are imposed when systems fail to meet their minimum criteria. Establishing blame is not only difficult, but contrary to the partnering mentality that the company wanted to promote. Firms look to find why the process failed and move to fix it as best they can. The result is an environment where everyone is striving to do better each time.

One firm has been putting its DP data on-line for 10 years. Division policy emphasizes openness of results throughout the corporation. The on-line reporting system tracks the daily performance of two data centers. Statistics are reported for each center and for each environment (TSO, CICS, etc.). The report contains a summary score for that center and environment. The score is based on availability and response criteria for that environment. If all criteria are met, the score is 100. Points are subtracted if any measure falls below the criterion for any hour of the day. Hourly histograms are provided to show where the failure occurred. Owners of processes that fall below the criterion must file an incident report on the reason for the failure.

They are now moving into a second-phase of measurement where their centralized on-line systems are being retired in favor of decentralized measurement by work teams. The on-line systems driven by machine measurement are still active, but most of the central measurements that required manual processing have been abandoned.

Table 4
Performance Measure Format

General descriptors for each service --

| | |
|-----------------------|--|
| Service description: | Definition Activities in that service |
| Service environment: | Geographic location Technical environment |
| References: | Related documents |
| Service availability: | Open for business |
| Report frequency: | Daily, weekly, monthly ... |

Specific descriptors for each service level --

| | |
|-------------------------|--|
| Service level criteria: | A statement of the desired level of performance for that service |
| Service level: | The percent of times the desired level is to be met. For non-machine criteria, the service level is expressed as a minimum level (required) and a target level (desired) |
| Severity code: | An indication of the importance of that criterion: 1 - significant impact large number affected 2 - minimal impact large number affected 3 - minimal impact moderate number affected |
| Measurement method: | The measurement technique or source of information for the criterion |

The monthly hardcopy report for one organization concentrates on resource utilization organized by application and by customer organization. The IS budget for CPU and DASD is divided by the application and organization use rendering a cost figure for each application and for each organization down to the individual end-user. Customers are not responsible for funding those costs (i.e., no money changes hands), but they do become aware how much they use the corporate resource. The cost data is also used to benchmark cost ratios against similar organizations in the industry.

Another hardcopy report highlights three attributes for special attention: safety (number and hours since last lost time), availability/reliability (percent up-time by environment) and customer service requests (number and call waiting time). The report also contains trend graphs on other system parameters. The organization is beginning to use statistical process control (SPC) limits to begin to measure the performance in these other domains.

This same data processing group has also negotiated a series of five quality measures with one of their computer service vendors. The report on this system generates a scorecard every month that results in a yes/no score on whether the system met the requirements.

Finally, the corporation benchmarks its costs against the Real Decisions database each year. Their goal is a 10% improvement against the industry average each year (in the face of an 18% improvement in the average itself).

Table 5

| PERFORMANCE MEASURES - INDUSTRY PERSPECTIVES | | | | |
|--|--|--|---|---|
| FINDINGS-DATA PROCESSING | | | | |
| COMPANY | OVERVIEW | DEVELOPMENT | EXAMPLES | REPORT |
| ABC | <ul style="list-style-type: none"> 170 measures of "utility service" Features -Service level criteria -Severity code -Measurement method | <ul style="list-style-type: none"> 3 year partnership with outsource Use of 3rd party facilitation | <ul style="list-style-type: none"> VM/CMS accessibility and useability = 98.5% of wall clock time | <ul style="list-style-type: none"> Monthly hardcopy with graphs Some quarterly statistics Annual report |
| EDF | <ul style="list-style-type: none"> 15 measures Features -Metrics name -Measures -Purpose -Type Occasional Real Decisions benchmark | <ul style="list-style-type: none"> Evolved over last four years IS mgmt. leadership with those responsible for measurement | <ul style="list-style-type: none"> Measure number of prime shift hours that CMS is not available to customer during the month-end close cycle | <ul style="list-style-type: none"> Monthly hardcopy with graphics Reorganizing report from department to product/service categories |
| GHI | N/A (no DP function) | N/A | N/A | N/A |
| JKL | <ul style="list-style-type: none"> Dialing on-line summary for each DP center Report card format (100 points) Drilldown to explanation of any measure that fails to get all 100 points Annual Real Decisions benchmark | <ul style="list-style-type: none"> 10 year evolution Each measure on report has an owner | <ul style="list-style-type: none"> Availability and response time for each DP Center By mode (TSO, CICS, Batch) Weight and grade (0-100) per system per mode | <ul style="list-style-type: none"> Daily trend data on-line Monthly hardcopy with graphs |
| MNO | <ul style="list-style-type: none"> Informal benchmark with industry Cost awareness | <ul style="list-style-type: none"> Standard operational measures Senior analyst developed benchmark and cost awareness | <ul style="list-style-type: none"> Cost CPU and DASD Divide cost by use for each application and user M/Pls | <ul style="list-style-type: none"> Monthly hardcopy with graphs |
| PQR | <ul style="list-style-type: none"> Standard measurements Compared to industry standards Safety measures stressed Annual Real Decisions benchmark | <ul style="list-style-type: none"> Long term evolution Computing operations as owners | <ul style="list-style-type: none"> Downtime Availability Meantime-to-fail Unscheduled interruptions | <ul style="list-style-type: none"> Monthly hardcopy with graphs |

Application Development

The application development departments (Table 6) are experiencing the most change in performance measurement of any IS function. Not only is software development in general experiencing rapid change, but the concepts and tools for getting beyond source lines of code (SLOC) are appearing.

Two firms have measured the quality of their in-house systems by tracking the performance of those systems in the field -- specifically measuring the number of ABENDS the system generates in its first quarter or year. During development, the most common measure is the number of incident or discrepancy reports per unit.

Many firms are planning to measure the function points in their systems. Analyzing the existing systems is a mammoth task, but they expect to gain more knowledge about their application development operation as a result. Respondents often mentioned the International Function Point Working Group (IFPWG) as the center of this movement.

Once function points for each system are available, organizations are then able to calculate the standard quality, schedule, and cost variables per function point. Some firms have adopted this strategy; others are collecting baseline data in preparation for adopting it; others are still studying the issue. But the trend right now is toward function point units as the basis of application productivity measures.

Application development -- examples

One company has a separate system for quality management of its applications development. They use periodic quality assurance reviews. Every major development effort is reviewed each quarter and at each major life-cycle milestone. The review is led by an independent reviewer who studies progress on the project and delivers a report to the executive sponsor, an IS representative, and the project manager. The manager also prepares a risk assessment and mitigation memorandum for the review. The review concludes with a written report on the status and risks for the project over the next period. The process does not produce any reportable metric except that the review took place.

Another firm captures personnel effort by project and by activity in order to measure staff effort in development, support, and administration in application development.

A third firm measures a few fundamental parameters of their work: the availability of the application, the proportion of times the application runs without error or interruption, the variance between planned and actual completion time of projects, and the timeliness of handling service requests. Each of these parameters is measured on a monthly basis and tracked using SPC control limits. Any values which fall outside of the limits are checked for improvement. (The timeliness parameter has not been implemented because they are having difficulty capturing when service requests begin and end.)

One applications development group is engaged in a three-pronged effort to increase its quality and performance. They had used an individual reporting system against a project

work-breakdown-structure (WBS), but the system was too burdensome to maintain. The first part of the new effort uses the Malcolm Baldrige criteria to grade each team's performance. The second aspect is to gauge the size and cost of their existing systems using function point analysis. Finally, they are participating as a research partner with a university and a vendor to try a set of university-developed tools to gather baseline productivity data on new applications. They intend to establish some type of permanent performance measurement for application development and support once they accumulate two years of baseline data. The emphasis is on enhancing development productivity.

This firm has developed an on-line system to grade specific applications. An analyst would rate the system on stability, responsiveness, flexibility, usefulness, and general satisfaction. Most applications have not been graded for a number of years, however, and the system is largely abandoned.

Many IS organizations execute a detailed service level agreement with each customer. The agreement covers the support of existing systems as well as the development of new ones. It not only spells out the work to be performed, but the measures used to judge the quality of that work. The firm then rates the quality of its application development on how well it performs on the service agreement.

One company reported that service level agreements used to be hard to meet, but as the organization has improved, all measures are met routinely. Productivity measurement of application development is based on a major study which calculated the function points in 175 existing systems. The organization undertook the study to justify the cost of moving to a CASE environment. The organization made the move, and are now positioning themselves to have the CASE tools automatically generate the function points in each new application. Once function points have been determined, the organization then calculates cost, schedule and quality measures per function point. The default quality measure is the number of incident reports on a finished system per function point.

The company believes that the uniform CASE environment will someday automate the process of productivity measurement. The CASE tools illustrate that the benefit of automating a process may lie as much in the information which the tools provide as the time that it saves.

Another application development group is reconstructing their performance measurements for application development following their reorganization. They are developing a new system with a radically different orientation. The purpose of the old system was vertical management control. Now they are using a horizontal system that emphasizes real-time process data. The old system tried to measure everything where the new system is oriented only to critical business issues (e.g., reduce cycle time, cost, defects, delays, etc.). Those collecting the measures did not have any influence on the measure in the old system. Now everyone involved must sign-off before the measure is implemented. Each measure also requires extensive documentation before approval,

including:

- critical business issue
- measures/goals (specific change to a product or process)
- critical processes (which processes are affected)
- process owner
- action plan
- estimated costs
- agreement by all parties

The action plan for the measure includes items on data collection, analysis, and reports, including typical tables and graphs.

The new system is under development at the current time. It is an attempt to combine performance measurement at the team level while retaining visibility at the corporate level.

Two firms mentioned that they do not have productivity measures based on work units right now, but that they expect to in the future once they are comfortable with their understanding of what would be an appropriate measure.

Table 6

| <i>PERFORMANCE MEASURES - INDUSTRY PERSPECTIVES</i> | |
|---|--|
| APPLICATION | |
| COMPANY | EXAMPLES |
| ABC | <ul style="list-style-type: none"> • Quality reviews for each major project each quarter |
| EDF | <ul style="list-style-type: none"> • Time & effort reports by project • Focusing more on quality and defects • No productivity measures • Used Real Decisions occasionally |
| GHI | <ul style="list-style-type: none"> • A few statistics gathered after deployment (ABENDS, etc.) • Monthly trend against SPC controls |
| JKL | <ul style="list-style-type: none"> • Team measures • Function point analysis • Productivity analysis |
| MNO | <ul style="list-style-type: none"> • Detailed service level agreements with customers • Function point analysis |
| PQR | <ul style="list-style-type: none"> • Complete plan and approval for each measure • Must address a significant business issue |

End-user Computing

No one has a handle on this rapidly changing technical area. First workstations, now LANs are exploding throughout the corporations. Many respondents did not think the systems could be measured until the technology stabilized and tools were developed for tracking activity and performance.

The best that most companies could do was the timeliness and quality of their service requests. One company tracked time to respond to problems, average age of problems, and number of calls put on hold. Two companies also tracked the time that a customer had to wait on the telephone as a measure of performance.

One firm had initiated a study to fully measure the cost of installing and operating local area networks (LANs). They suspect that mainframe revenue has partially subsidized those costs.

Measuring end-user computing performance is even more difficult in a strongly customer focused organization. Some companies reported outmoded measures such as availability of a particular region or application on the mainframe as a measure of end-user availability. That measure obviously neglects the performance of the network. Network performance measures are now available, but they still cannot tell whether an individual PC is turned on and functioning properly. One IS manager estimated that he would have those tools in two to three years, but until then, he was not satisfied that he had a good approach to validly measuring end-user performance.

CONCLUSION

Overall, respondents were quite satisfied with their performance measurement systems. Table 7 lists the specific satisfaction by organization. The one exception was a firm that had not been collecting performance measures very long and had not devoted significant resources to the task. They viewed their system as "OK," but it did not figure strongly into the organization's goals or improvement strategies. The overall satisfaction, however, did not deter firms from continuing to improve their already good processes. As mentioned above, they were trying to reduce the number of measures they collected and link them more closely to the business goals. Some organizations had given work teams the responsibility for collecting most of the measures, and others were continuing to strengthen their ties with their customers.

Table 7

| <i>PERFORMANCE MEASURES - INDUSTRY PERSPECTIVES</i> | |
|---|--|
| SUMMARY & CONCLUSIONS | |
| COMPANY | SATISFACTION |
| ABC | <ul style="list-style-type: none"> • Good start with utility measures • Quality assurance has worked well • Customer satisfaction believed on right track |
| DEF | <ul style="list-style-type: none"> • Fairly satisfied, particularly with surveys • Concentrating more on quality measures • Trying to reduce number of measures |
| GHI | <ul style="list-style-type: none"> • Low degree of satisfaction • Little impact on behavior or process improvement |
| JKL | <ul style="list-style-type: none"> • Quality initiatives successful • Reversal of negative IS image • Moving measures to team level |
| MNO | <ul style="list-style-type: none"> • Good progress • More work to be done especially in stockholder satisfaction |
| PQR | <ul style="list-style-type: none"> • Rebuilding measures after reorganization • Quite satisfied so far • Continuing to improve |

RECOMMENDATIONS TO NASA

From Industry Respondents

The interview team asked each respondent about their specific recommendations to NASA as they embark on the process of redesigning their performance measurement systems. Each organization which had specific recommendations shared a slightly different orientation.

One respondent spoke of the need to establish a good working relationship with their major contractor. They found that they were more successful in measuring performance when they formed an equitable partnership based on working together to achieve a high quality IS organization:

- establish a relationship based on the desire for quality
- strive to be fair to both parties at all times
- start with some historical data as the basis for negotiation
- define terms carefully
- expect a long process

A second respondent reflected on the need to plan and develop the performance measurement system carefully and to review it often:

- plan the measurement system; don't just let it happen
- people who carry out the process can design better measures than technical consultants or managers can
- keep the focus on improvement rather than catching someone doing something wrong
- too many measurements are as unhelpful as too few
- use measurement for improvement and drop the measure once the improvement has taken place
- periodically review the system and eliminate obsolete measures
- measures do not need to be any more precise than the decisions and actions that depend on them
- raw data and tools for analysis are better for executives than summarized reports are

Another set of recommendations focused on the overall purpose of the performance measurement system and what NASA could expect to find when they are finished:

- developing adequate measures requires long-term commitment
- concentrate on measures which are important to the customer
- measurement goal is productivity not policing
- measurement usually results in re-engineering the process
- use outside groups to benchmark performance

A final list emphasized the customer's perspective and role in deciding which products and services to develop and to measure:

- ask customer group what their products and services are and what focus IS should have
- ask the IS organization to develop a marketing brochure (TIP: if it looks like an organization chart, it is not customer-oriented)

Developed From Research Findings

- * strong, consistent executive level commitment is required for the development of a performance measurement system
- * form a performance measurement working group to oversee, facilitate and coordinate development efforts
- * budget adequate resources and time to develop and implement the system

- * provide for meaningful and adequate training for employees so that they can understand the system and fully participate in its development and implementation
- * use a team-approach to developing measures, including the people most involved with the area to be measured
- * include vendors in performance measurement development
- * use a customer-oriented focus for the performance measures
- * use performance measures to support improvement

APPENDIX A: PERFORMANCE MEASURES INTERVIEW

Organization: **Representatives:**
Interviewers: Peter Bishop, Cissy Yoes (UH-Clear Lake)
Location:
Date, Time:

Purpose of the Interview:

The purpose of this interview is to obtain a description of how your organization uses performance measures, what measures you use, and why you consider them important. This information is being gathered to help the Information Systems Directorate at JSC/NASA in the redesign of their performance measures. During this interview, our objectives are the following:

- 1) Introduce the study we are doing.
- 2) Obtain a description of your performance measurement system and how you designed and implemented it.
- 3) Understand what your performance measures are, how you use them, and how satisfied you are with these measures.
- 4) Share a performance measures model that we have developed for this study and solicit your comments on the model's validity and usefulness.
- 5) Obtain any documents you are willing to share with us, such as, consulting reports, metrics, process descriptions, and internal reports at various levels.

Agenda:

Introduction

- UHCL project
- confidentiality requirements

Description of Information Systems Organization

- mission, goals, scope
- organizational structure
- operations

Overview of Performance Measures

- design
- implementation
- operations
- reporting

Assessment of Performance Measures System

- satisfaction
- problems
- lessons learned
- recommendations to others in development stage

**UHCL Performance Measures Model (may be discussed earlier
at respondent's request)**

- overview
- comments

Closure

APPENDIX B: THE LIFECYCLE OF PERFORMANCE MEASUREMENT

Firms did not directly articulate a life-cycle for measurement systems, but piecing their stories together shows there appears to be one. Every firm has a distant past when they took no measurements and, in fact, hardly considered them. The situation was analogous to end-user computing today. The rapid rate of technological change and the lack of standard tools made measurement difficult if not impossible. That situation existed in mainframes before SMF, MICS, and Real Decisions came along. We will call it Phase 0.

Phase 1 begins when firms first consider doing some measurement. They feel the need to improve the system. Something is wrong, and the measures are developed to find out what it is and how to fix it. Ironically, many firms stop at this phase. They expect negative results from their initial measurements. They are afraid that the results will put them in a bad light in the eyes of upper management or that their customers will vent their frustrations all over them. They say, "We already know what the problems are. We don't need measures to tell us that."

In fact, initial measurements usually do show some serious problems. (That's what they were instituted for!) And customers, long carrying their frustration in silence, do unload on the first person who asks them what they think of the IS department. But no one has reported serious injury from these encounters (except perhaps to their egos), and what is more important, the measurements and the feedback actually improve. That's Phase 2 -- the improvement phase.

Phase 3 occurs at the critical juncture when the measures plateau at a high value. Measures such as 99.8% availability, 0.2 sec response time, and 97% customer satisfaction are hard to beat. Interest in measurement wanes at this point. Some firms keep increasing the standard to keep effort directed on the task. Some change the measurement strategy to some other attribute. Some recommend dropping the measure altogether and moving on to other topics. Others change their whole approach to measurement, adopting the team approach or the executive interview as the primary measures.

The ironic conclusion to the lifecycle analysis is that firms who measure heavily believe that they have a moderate problems. Firms with problems that are too big are afraid of the results. Firms with problems that are too small cannot justify the time and cost of measurement. Both will have to measure sometime, however. The first group must ultimately improve or go out of business, and the second group will ultimately adopt new goals that require measurement and improvement. The result is that measurement comes sooner or later to every organization.

APPENDIX C: A TAXONOMY OF PERFORMANCE MEASUREMENT SYSTEMS

The first task is to explain the nature of each performance measurement system in terms of industry or corporate variables which affect the IS organization. The sample is too small to test these relationships statistically. Nevertheless, a small set of variables do describe each firm's system in terms of its larger context. Furthermore, these variable might be the subject of continued research with a larger sample.

Table 8
Explanatory Variables for Performance Measurement Systems

| Company | Cost pressures | Quality program | Restructured organization | Corporate culture | Result: PM System |
|---------|------------------|-----------------|---------------------------|-------------------|--------------------|
| MNO | Yes (internal) | --- | --- | --- | Benchmark CASE |
| ABC | Yes (outsourced) | --- | --- | --- | Detailed agreement |
| GHI | No | No | --- | --- | Few measures |
| EDF | No | Yes | No | --- | Defects, satisfac. |
| JKL | No | Yes | Yes | Decentral | Team ownership |
| PQR | No | Yes | Yes | Central | Executive focus |

The primary explanatory variables are listed in Table VII. This table does not explain everything unique or interesting about the various firms described, but it does capture some of the major items.

The first variable describes whether the IS organization felt that they were under cost pressures. Two organizations did feel that they were, but they adopted different strategies to deal with that pressure. One firm reduced its headcount and monitored its industry closely. Its objective was to reduce costs and keep them down. One of their measurement strategies was to benchmark industry costs and use that to justify their annual budgets. They also

moved aggressively into a CASE development environment which, though initially costly, was justified on a cost-savings basis.

The other response to cost pressure was to outsource the IS function. The resulting performance measurement system was the most detailed of the sample. Firm and contractor chose to develop this level of detail in order to reach their mutual quality objectives and still be assured that the system was fair to both sides.

In this model, cost pressure preempts the other variables. While firms under cost pressure also have quality programs and other organizational experience, they do not seem to impact the type of performance measurement system they adopt (at least in this small sample).

Of those firms that did not indicate significant IS cost pressure, the next question is whether they had a strong quality focus in place. One firm did not. As a result, they had the fewest measures in the sample. It would seem then that either cost or quality must be strong to have a fully developed performance measurement program.

Of the firms that had little cost pressure and a strong quality focus, one was just now shifting its focus from availability and response measures (i.e., machine-oriented measures) to defect reduction and customer satisfaction (i.e., customer-oriented measures). This shift is the beginning of a thoroughgoing change in measurement strategy noticed in the last two firms.

Differences also remain between the two firms that have pursued a quality measurement program after restructuring. The cultures of the two firms are very different -- one emphasizes individuality, autonomy, and decentralized activity. Their performance measurement system "grew up" over the years without much central direction. The result is a measurement system which has become highly decentralized. Each team develops and maintains its own measurement system. These systems are not secret. In fact, they are plastered over every wall in the building. But they are not centrally rationalized or reported. Customer measures remain good (even better than before) so management is content that the decentralized system is working.

The other firm is still quite centralized. While IS has changed much in the last few years, they still believe that their most effective strategy is to maintain a strong leadership position in IS for their business units. Their goal is to be valued business partners rather than merely a supplier of IS products and services. And their performance system mirrors that goal. Its key element is the satisfaction of the executive customer in each business unit. Those views are actively solicited and used in strategic and tactical planning.

This framework is extremely preliminary. It represents more a direction for future research than an established theory. In the meantime, however, the framework might direct attention to the fact that the systems described are a function of the business environment and the stakeholder goals in each firm.